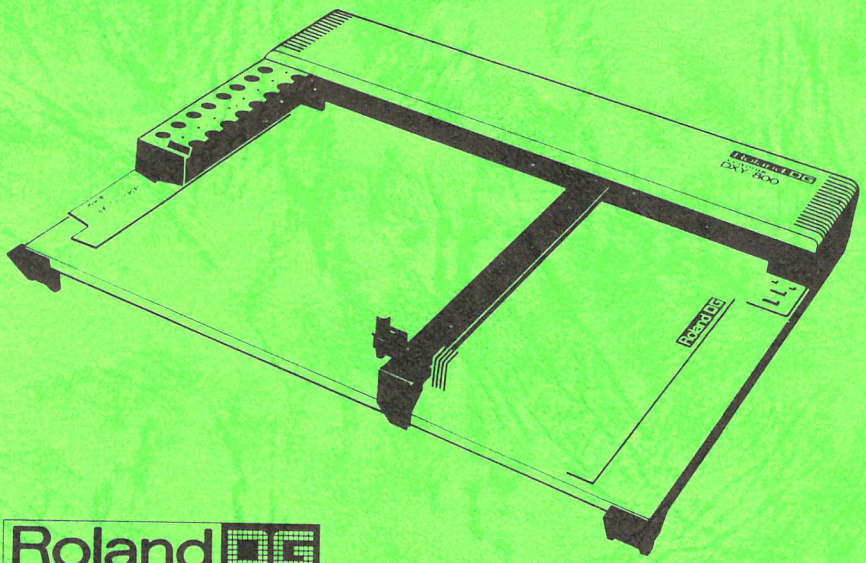
Operation Manual

Roland DG



Roland DG

X-Y PLOTTER

DXY-800
DXY-101

Table of Contents

I. Introduction 2
II. Basic Procedures 5
III. Computer Connection 9
IV. Drawing Commands 15
V. Appendices 26

* Apple is a registered trademark of Apple Computer, Inc. of USA and APPLE II and APPLE IIe are the trade names of its products.

* IBM is a registered trademark of International Business Machines Corporation of USA and IBM-PC is the trade name of its products.

* Tandy is a registered trademark of Tandy Corporation of USA and TRS-80 is the trade name of its products.

I .Introduction.

1. Brief Descripfion

The DXY-800 and DXY-101 are compact, lightweight, high speed X-Y plotters with exchangeable pens (DXY-800 only) and realize excellent cost performance. By connecting a computer, letters, figures and graphs can be drawn easily. These plotters permit much clearer and more accurate drawing of pictorial output than is possible with an ordinary printer.

Some of the many outstanding features of the DXY-800 and DXY-101 are as follows.

1. Compact and lightweight. Can be installed vertically (60°).
   A more compact, lightweight design has been realized over conventional models, with a width of 496mm, a depth of 435mm, a height of 77mm and a weight of 4.1kg (DXY-800 unit only). In addition, vertical installation is possible by using the accessory stand. This allows the unit to be freely installed in any location.

2. An abundance of functions are provided and control commands are simple.
   A wide variety of command functions such as vectors, characters and graphics are available, along with replaceable pens, as standard features. In addition, such items as circles, arcs and hatching can be drawn just as you desire. What is more, control commands are simple using BASIC.

3. Pen movement permits drawing in 0.1 mm steps and paper up to 420 mm by 297 mm can be used.
   Since pen movement is in 0.1mm steps, coordinate designation or calculation in the program are simple. In addition, recording papers smaller than 420mm x 297mm can be used.

4. Felt tip pens can be used.
   In addition to eight special color pens, by using the accessory pen holder, felt tip pens can be used. Depending on the condition of the pen used, drawing speed can be switched between two settings (180mm/sec and 90mm/sec).

5. Easy to connect to a computer.
   Simple connection is possible for a computer which is connectable to a printer having standard Centronics specifications. In addition, RS-232C specifications interface is available.

6. AC adapter system power supply
   Equipment stability and safety have been improved by separating the DC pack power supply system from the unit. A hook hole is provided to allow the pack to be hung on a wall.

2. Packing Checklist

The following accessories are packed in the box of the DXY-800 or DXY-101, along with the plotter unit. Be sure to check that all of the required accessories are in the packing box prior to use.

Item	DXY-800	DXY-101
(1) Special pens	(Black, red, brown, blue, green, purple, orange, pink) 8	(Black only) 1
(2) Magnetic sheet for holding recording paper	1	2
(3) Pen holder	4	1
(4) AC adapter	1	1
(5) Stand	1	1
(6) Operation Manual	1	1
(7) Position setting seals	0	1

3. Precautions.

Installation

- Place the unit on a flat, stable stand or install vertically (60°) using the accessory stand.
- Avoid locations where the unit will be exposed to direct sunlight, high temperature environments, and dusty or humid locations.
- Do not use in a location which has heavy vibration or in noisy environments.
- Since the power supply (AC adapter) generates heat when used, place in a location suitable to heat dissipation (a location having good ventilation).

Use

- Insure that the power supply cord and computer input/output cables are installed in such a manner as to prevent accidents or disconnection while in use.
- When connecting with a computer, be sure to perform an operation check (Refer to page 8) to confirm that there are no abnormalities.
- Prior to turning power on, set the pen carriage to the lower left. If not set in this position, not only will the most effective drawing range not be obtained, but with the DXY-800, it will not be possible to exchange pens.
- Do not block the ventilation openings on this unit or place items over the AC adapter .

After using or when not using

- In order to prevent ink evaporation, when not using the pens, cover them with the caps or put them in the penstock (DXY-800).
- When not using the unit, be sure to remove the power supply plug from the outlet.
- When not using the unit, remove the pen from the pen clip and pen carriage.

Other

- Never lubricate any of the mechanical parts.
- Never place heavy objects on the drawing board or allow it to become scratched.
- Do not apply strong force to the arm or carriage and avoid impact.
- If the drawing board or the X rail cover are stained, clean them lightly with cloth using neutral detergent.
- **Do not move the arm or carriage manually after turning power on.**

II. Basic Procedures.

1. Names of sections.

Fig. 1
- External View

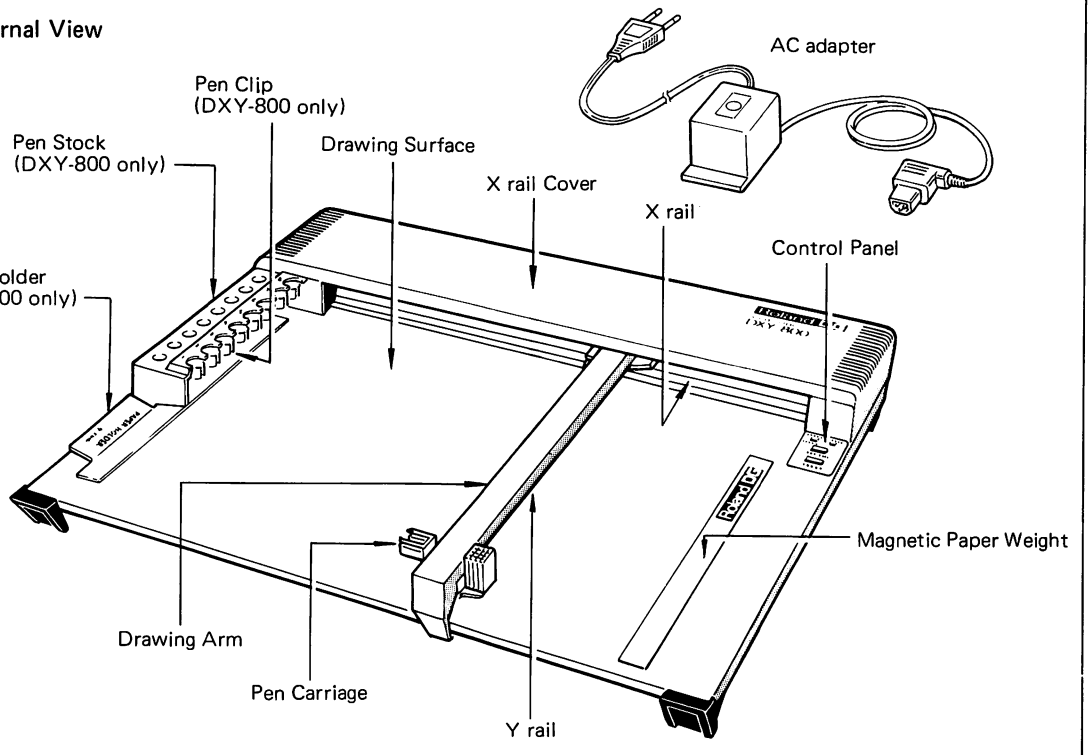


Fig. 2
- Rear Panel

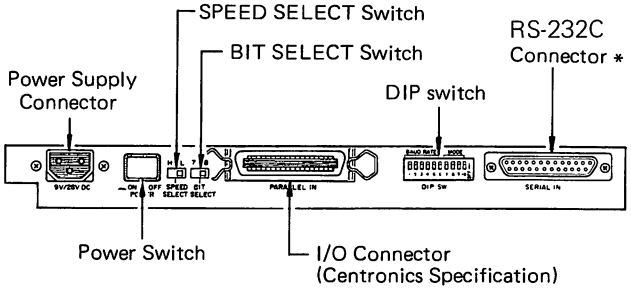
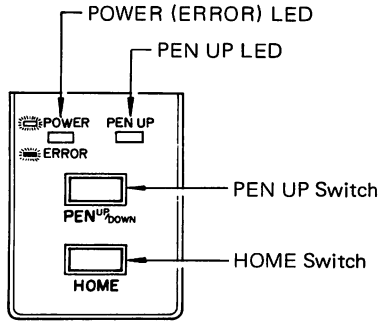


Fig. 3
- Control Panel



*Do not use (connect) at the same time as a Centronics specifications connector.

2. Power Supply (AC Adapter) Connections.

1. Check to see that the plotter unit power switch is off, then connect the AC adapter to the power supply connector of the plotter unit.
2. Plug the power supply plug of the AC adapter into an AC outlet.

3. Loading Recording Paper.

Load the recording paper in the following sequence.

- **DXY-800**

1. Open the paper holder and insert the left edge of the recording paper in the holder.

Fig. 4

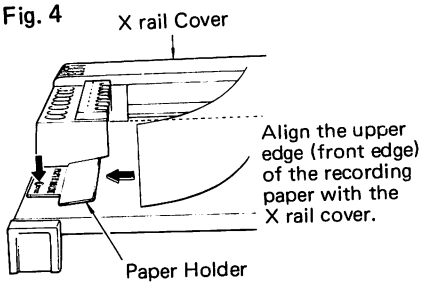
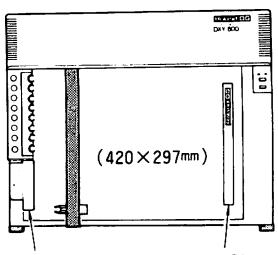
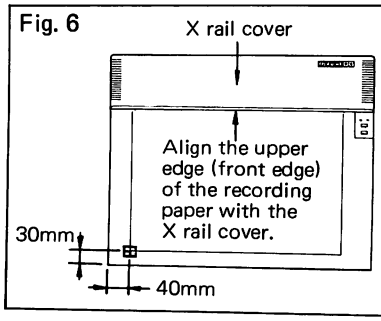


Fig. 5



2. Align the upper edge (front edge) of the recording paper with the X rail cover.
3. Close the paper holder and secure the left edge of the recording paper, insuring that the paper has no creases or looseness, and secure the right edge using the magnet sheet.

Fig. 6

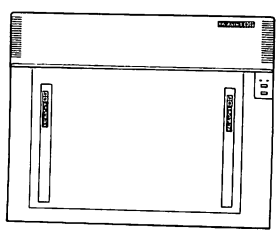


- **DXY-101**

1. If a pen is already installed in the pen carriage, remove the pen.
2. When using the paper in 420mm x 297mm size, affix the accessory position setting seals.
   Since there are extra seals, these are convenient for position setting of other sizes.

Note: The seals are made using a material which has no effect on the drawing, however, avoid affixing in the drawing area as much as possible.

Fig. 7



3. Align using the recording paper position setting seals and secure using the magnet sheet. At this time, insure that there are no creases or looseness in the recording paper.

The recording paper should have the proper ink absorption properties, should not stretch or shrink with variations in the humidity and should be smaller than 420mm x 297mm. High quality graph paper, coated paper or tracing paper are best, but, depending on the application, copy paper or OHP (overhead projector) transparent film may also be used.

4. Recording Pen Installation.

Fig. 8

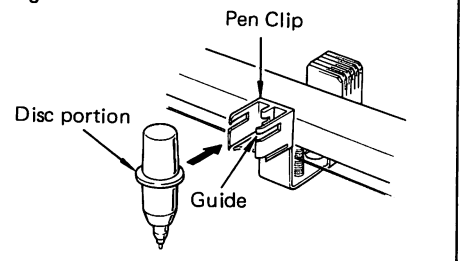
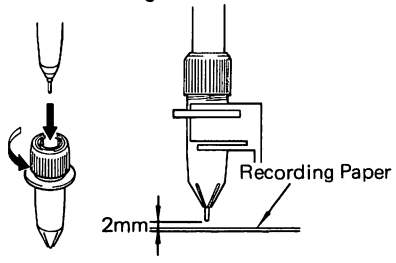


Fig. 9 Fig. 10



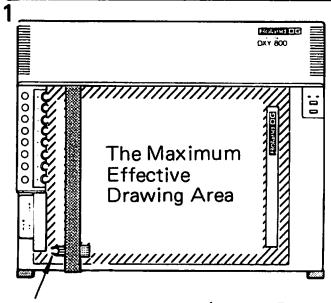
Align the disc portion of the accessory pen holder containing the special pen with the guide portion of the pen carriage or pen clip and insert gently.

- Installing a felt tip pen in the pen holder
  Use a high quality pen which has an outside diameter of 9.5mm or less and a weight of 7g or less.
  The standard distance between the tip of the pen and the recording paper is 2mm, however, this varies depending on the type and shape of the pen. Therefore, it is alright if the distance is a little greater or smaller. Install using the following procedure.

1. Turn the top portion of the pen holder counterclockwise to loosen it.
2. Load a pen and gently turn the top portion of the pen holder clockwise to secure the pen.
3. Install in the pen carriage, adjust the wick length and tighten by turning the top portion of the pen holder clockwise and secure the pen.

5. Setting the Drawing Point of Origin.

Fig. 11

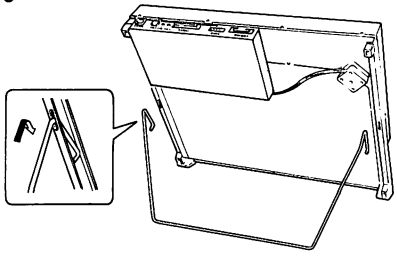


For the DXY-800 and DXY-101, the position of the pen when the power is turned on becomes the drawing point of origin (home position, coordinates 0,0). Drawing is only performed to the right and above that point of origin.
Because of this, prior to turning power on, be sure to set the position of the pen to the lower left. If not set correctly, the maximum effective drawing area cannot be obtained and, with the DXY-800, pen exchange will not be possible.
Prior to turning power on, be sure to manually set the position of the pen carriage to the lower left.

- When setting manually, be sure to avoid applying too much pressure on the pen carriage or moving too quickly.
- Do not move the arm or carriage manually while the power is on.
- DXY-800 and DXY-101 are different in drawing area.

6. How to Use the Stand.

Fig. 12



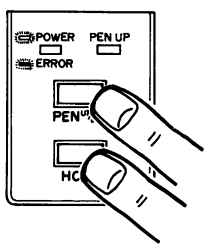
Be sure to use the stand when using the DXY-800 or DXY-101 in a vertical position (60°).
Attach the stand to the long slots on the back of the plotter.

Take the following precautions when using the plotter in a vertical position.

- Be sure to place on a flat, stable surface.
- Do not apply excessive pressure on the surface of the plotter or on the stand.

7. Operation Check (Self-Test Mode)

Fig. 13



- **DXY-800**

1. Load pens in pen clip numbers 1 through 8.
2. Turn power on while pressing the PEN UP switch and the HOME switch.

The carriage will change pens in sequence from number 1 through number 8 and will go through the movements for drawing " ⊡ " of the N command with each one. Finally, the system will return to the drawing point of origin (home position) and the test will be complete. Since this operation is performed in the pen up condition, by pressing the PEN UP switch once more, the system will go to a pen down condition and actual drawings can be made on the recording paper.

- **DXY-101**

1. Load a pen in the pen carriage.
2. Turn power on while pressing the PEN UP switch and the HOME switch.

The carriage will transit the outside of the effective drawing area and coordinates (0, 2600), (2600, 3700) and (3700, 0) and return to the point of origin (home position). Then it will go through the movements for drawing "*" of the N command and the test will be complete. Since the pen up condition is designated, even in the pen down condition, only a "*" symbol can be drawn.

1. Parallel Interface

Fig. 14

APPLE II		DXY-800, 101	
Signal		Signal	Pin
$\overline{\text{STROBE}}$	—	$\overline{\text{STROBE}}$	1
DB0	—	D0	2
DB1	—	D1	3
DB2	—	D2	4
DB3	—	D3	5
DB4	—	D4	6
DB5	—	D5	7
DB6	—	D6	8
DB7	—	D7	9
$\overline{\text{ACK}}$	—	$\overline{\text{ACK}}$	10
GND	—	GND	19 ~ 30

① Main Computer Connection

In this example, we will explain how to connect an APPLE II, IBM-PC, TRS-80. Basically, if a computer is available which has standard Centronics specifications input/output terminals for printer connection, the DXY-800 and DXY-101 can be connected to the printer connector without modification. In the case of other types of computers, refer to the printer connection section of the operation manual for the respective computer and make the connection accordingly.

After connection, place the DXY-800 or DXY-101 in the PRINTER mode (Refer to page 21) and when a computer-to-printer print command is sent, if correct printout is made by the plotter, then the DXY-800 or DXY-101 is connected correctly.

- **APPLE II, IIe (Apple)**

  Use a parallel printer interface card (Roland D G APPLE II parallel interface board or APPLE A2B0002). By using this card, data transfer similar to a printer is possible using PR#n command.

  Perform connection as shown Fig 14.

- **TRS-80 (Tandy)**

  A Tandy Radio Shack expansion interface (Catalog No. 26-26-1140-1) and a cable are required when connecting the DXY-800 or DXY-101 to a TRS-80.

  Use a Tandy Radio Shack cable (Centronics specifications) or make your own by closely following the specifications outlined in the expansion interface manual and on P. 10 ②-(1) of this manual.

- **IBM-PC (IBM)**

  An IBM monochrome monitor/printer interface card and a cable are required when connecting the DXY-800 or DXY-101 to an IBM-PC.

  Use an IBM printer cable.

  When operating the DXY-800 or DXY-101 using IBM-BASIC (BASIC A), a "Device Time Out Error" may occur. In this case, the printer BUSY signal will become HIGH level and an error message is output. Refer to the note on P. 22 concerning the IBM-PC, and the sample program on P. 26.

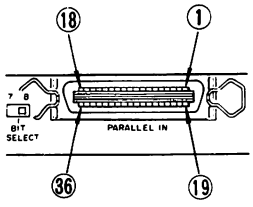
②Input/Output Data.

(1) Connection

Use DDK 57-30360 or equivalent as a connector. Pin arrangement is as follows.

Fig. 15

NC	36	18	NC
NC	35	17	GND
NC	34	16	GND
GND	33	15	NC
$\overline{\text{ERROR}}$	32	14	NC
NC	31	13	HIGH ☆
GND	30	12	GND
"	29	11	BUSY
"	28	10	$\overline{\text{ACK}}$
"	27	9	* D7
"	26	8	D6
"	25	7	D5
"	24	6	D4
"	23	5	D3
"	22	4	D2
"	21	3	D1
"	20	2	Dϕ
"	19	1	$\overline{\text{STROBE}}$



☆ 4.7k +5V

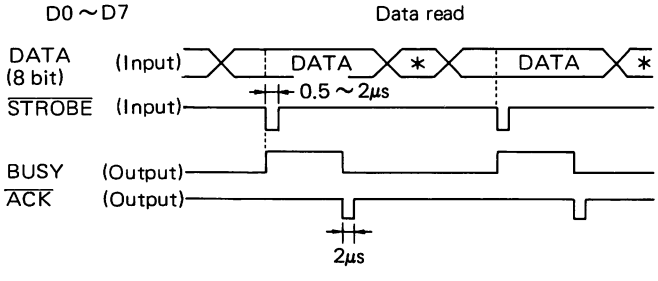
* If the bit select switch is set to 7, the system becomes NC.

(2) Input/output connector hookup

Input data signals consist of 8-bit data (D0 through D7). An input data signal (D0 through D7) is sent via pins 2 through 9. Next, a $\overline{\text{STROBE}}$ signal is input. At this time, the plotter BUSY signal comes ON and an $\overline{\text{ACK}}$ signal is output and data is read and the drawing operation starts. When the designated operation is completed, the system goes to a condition awaiting the next data input.

When making input/output cables, cable length should be 1.5m or less.

Fig. 16



*This portion of the data is disregarded.

Input/output signal timing chart

2. Serial Interface

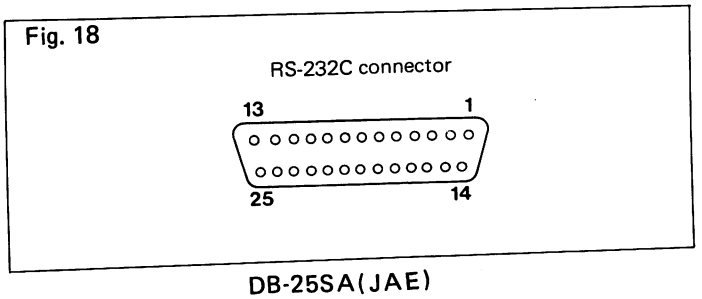
① Connector Pin Assignment.

The DXY-800 and DXY-101 are provided the RS-232C specifications connector to permit connection to a computer having an RS-232C specifications connector.

Fig. 17

Pin* Number	Symbol	Computer Side RS-232C	DXY-800 and DXY-101 Side RS-232C		
				Signal Name	Signal Direction
1	AA	PG (Protective Ground)	Frame ground	PG	–
2	BA	TD (Transmitted Data)	Serial data from computer side	RxD	Receive
3	BB	RD (Received Data)	Open		NC
4	CA	RTS (Request to Send)	RTS from computer side	REQ	Receive
5	CB	CTS (Clear to Send)	CTS from plotter side	READY	Send
6	CC	DSR (Data Set Ready)	Connected to CD (Data Terminal Ready)	DTR · ACK	Send
7	AB	SG (Signal Ground)	Signal line GND	SG	–
8	CF	DCD (Data Carrier Detector)	Open		NC
9 – 18		NC	Open		NC
20	CD	DTR (Data Terminal Ready)	Connected to CC (Data Set Ready)	DTR	Receive
21 – 25		NC	Open		NC
19		NC	BUSY from plotter side	$\overline{\text{BUSY}}$	SEND

Fig. 18



DB-25SA(JAE)

② Connecting to a Computer

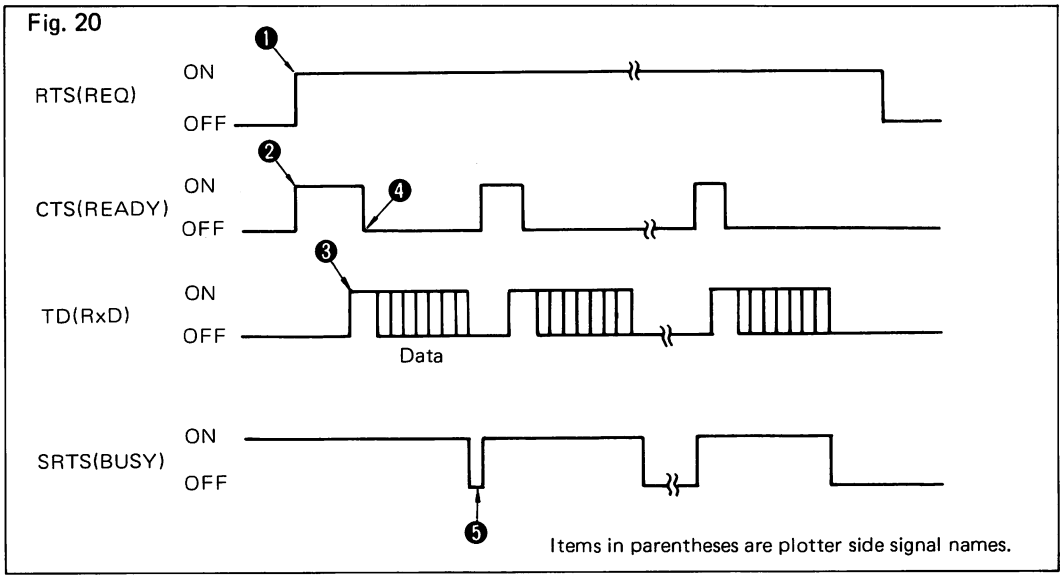
Fig. 19

Computer Side		DXY-800, DXY-101	
Signal Name	Pin No.	Pin No.	Signal Name
PG	1	1	PG
TD	2	2	R x D
RD	3	3	NC
RTS	4	4	REQ
CTS	5	5	READY
DSR	6	6	DTR · ACK
SG	7	7	SG
DCD	8	8	NC
S·RTS	19	19	$\overline{\text{BUSY}}$
DTR	20	20	DTR

Data transfer between the computer and the plotter is performed by handshake using RTS, CTS, REQ and READY signals.
Consequently, operations where READY or $\overline{\text{BUSY}}$ is disregarded and data is sent cannot be guaranteed.

Timing chart

Fig. 20



Computer side		Plotter side
❶ RTS: ON	⇨	REQ: ON ⇩
❷ CTS: ON ⇩	⇦	READY: ON
❸ TD: ON ⇩		

❹ (READY) is reset (goes OFF) when a start bit is received, and is set (comes ON) when data is read by the DXY-800 or DXY-101.

❺ ($\overline{\text{BUSY}}$) is reset (goes OFF) for a period of one stop bit, and is set (comes ON) when data is read by the DXY-800 or DXY-101.

- **IBM-PC**

When using the DXY-800 or DXY-101 with an RS-232C interface, be sure to check the RS-232C control software procedures prior to connecting.
Since the DXY-800 and DXY-101 receive data by handshake, they have control signals for erroneous timing (READY or BUSY).

Fig. 21

(IBM-PC)			(DXY-800, DXY-101)	
Signal Name	Pin No.		Pin No.	Signal Name
FG	1	——	1	PG
EIA TX DATA	2	——	2	R x D
	3		3	NC
EIA RTS	4	——	4	REQ
EIA CTS	5	——	5	READY
EIA DSR	6	——	6	DTR ACK
SIGNAL GND	7	——	7	SIG GND
	8		8	
	19		19	$\overline{\text{BUSY}}$
EIA DTR	20	——	20	DTR

The above connection diagram shows a connection made using an RS-232C interface card, and is based on CP/M-86.
* CP/M is the trademark of Digital Reserch.

- **APPLE II, IIe**

Connect using Super Serial Card (Reorder Apple Product #2L0044) and exclusive connector cable.

Fig. 22

(APPLE II)			(DXY-800, DXY-101)	
Signal Name	Pin No.		Pin No.	Signal Name
FRM GND	1	——	1	PG
T x D	2	——	2	R x D
	3		3	NC
RTS	4	——	4	REQ
CTS	5	——	5	READY
DSR	6	——	6	DTR · ACK
SGL GND	7	——	7	SIG GND
DCD	8		8	NC
S.CTS	19	——	19	$\overline{\text{BUSY}}$
DTR	20	——	20	DTR

(Note)
When connecting to an APPLE II, be sure to set the bit select switch to "7". ("8" will result in an error and operation will not be possible.)
For Super Serial Card setting, set the Jumper Block to "MODEM", turn switch 7 of DIP switch 1 OFF, and turn switch 7 of DIP switch 2 OFF.

3. Input Data Code

The DXY-800/101 is designed to accept standard **ASCII** (American Standard Code for Information Interchange) code.

Fig. 23

ASCII Code Table

D3	D2	D1	D0	D7 D6 D5 D4	0 0 0 0	0 0 0 1	0 0 1 0	0 0 1 1	0 1 0 0	0 1 0 1	0 1 1 0	0 1 1 1
					0	1	2	3	4	5	6	7
0	0	0	0	0		.	SP	0	@	P		p
0	0	0	1	1		•	!	1	A	Q	a	q
0	0	1	0	2		◇	"	2	B	R	b	r
0	0	1	1	3		□	#	3	C	S	c	s
0	1	0	0	4		△	$	4	D	T	d	t
0	1	0	1	5		⧖	%	5	; E	U	e	u
0	1	1	0	6		⏀	&	6	F	V	f	v
0	1	1	1	7		×	'	7	G	W	g	w
1	0	0	0	8		⌑	(	8	H	X	h	x
1	0	0	1	9		✳	)	9	I	Y	i	y
1	0	1	0	A	L_F	✡	*	:	J	Z	j	z
1	0	1	1	B		ESC	+	:	K	[	k	{
1	1	0	0	C			'	<	L	\	l	|
1	1	0	1	D	C_R		−	=	M	]	m	}
1	1	1	0	E			.	>	N	↑	n	~
1	1	1	1	F			/	?	O	←	o	SP

Note. If an undefined code is received by the DXY-800/101, the ERROR light will turn on, and the ERROR line, (pin 32), will go Low.

Notice that the ASCII code is a 7 bit code, and that there are 8 bits on the data bus.

The DXY-800/101 does not function unless bit 7 is set to Low (except after 'P' Command).

The table shows ASCII code and its corresponding binary digit, and hex digit. (msd; most significant digit, lsd; least significant digit)

ASCII code	A	
binary digit	0 1 0 0	0 0 0 1
	msd	lsd
hex digit	4	1
(decimal digit)	65	

1. List of Drawing Commands.

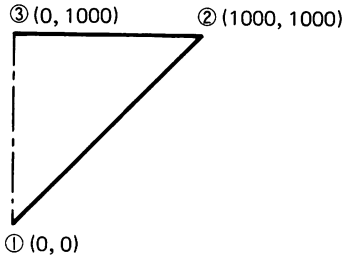
Fig. 24

Command		Input Format
H	HOME	H
D	DRAW	Dx1, y1, x2, y2, . . . xn, yn
M	MOVE	Mx, y
I	RELATIVE DRAW	I x1, y1, x2, y2, . . . xn, yn
R	RELATIVE MOVE	R x1, y2
L	LINE TYPE	Lp
B	LINE SCALE	Bℓ
X	AXIS	Xp, q, r
S	ALPHA SCALE	Sn
Q	ALPHA ROTATE	Qn
P	PRINT	Pc1c2 . . . cn
N	MARK	Nn
ESC	EXCHANGE	(ESC) or CHR$ (27) + "n"
J	PEN CHANGE	Jn (DXY-800 only) *
C	CIRCLE	Cx, y, r, θ1, θ2
E	RELATIVE CIRCLE	Er, θ1, θ2
A	CIRCLE CENTER	Ax, y
G	A + CIRCLE	Gr, θ1, θ2
K	A + %	Kn, ℓ1, ℓ2
T	HATCHING	Tn, x, y, d, t

* For the DXY-101, a "J" command results in an error.

2. Drawing Commands.

Fig. 25



1. "H" command (H)

Moves the system to the home position (0, 0) in a pen up condition.

*When there is an error, the error indication is cleared using this command.

```
10 REM *** Listing #1. ***
20 REM *** The 'H' command. ***
30 LPRINT "H"
```

2. "D" command (Dx$_1$, y$_1$, x$_2$, y$_2$, ... xn, yn)

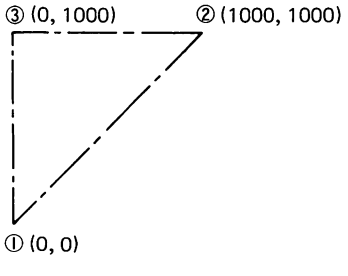
Draws a line from the current pen position to (x$_1$, y$_1$),(x$_2$, y$_2$) · · · · · to (xn, yn), in sequence.

"x" and "y" values are integers of up to 4 digits which are multiples of 0.1mm and are all absolute coordinates.

```
10 REM *** Listing #1. ***
20 REM *** The 'D' command. ***
30 REM --- No 1 ---
40 X1=1000:Y1=1000
50 LPRINT "D";X1;",";Y1
60 REM --- No 2 ---
70 LPRINT "D0,1000"
80 LPRINT "H"
```

The above program draws lines as shown in Fig. 25. (The space between ③ and ① in the drawing is a pen up movement.)
Lines 40 and 50 in the program are convenient for when lines are drawn using many READ DATA statements and FOR-NEXT statements, etc.

Fig. 26



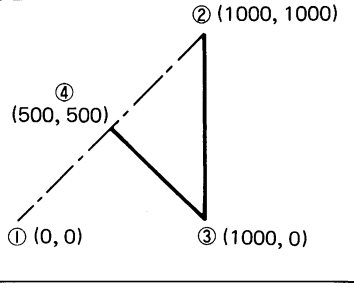
3. "M" command (Mx, y)

Performs the same movement as the "D" command in a pen up condition.

```
10 REM *** Listing #2. ***
20 REM *** The 'M' command. ***
30 REM --- No 1 ---
40 X1=1000:Y1=1000
50 LPRINT "M";X1;",";Y1
60 REM --- No 2 ---
70 LPRINT "M0,1000"
80 LPRINT "H"
```

Moves from ① to ② to ③ to ① in a pen up condition. (Fig. 26)

Fig. 27



4. "I" command (IΔx$_1$, Δy$_1$, Δx$_2$, Δy$_2$ · · · · Δxn, yn)

Draw lines while moving from the current position for a distance expressed by the relative difference (Δx,Δy).
"x" and "y" values are integers of up to 4 digits which are multiples of 0.1mm and are all absolute coordinates.

```
10 REM *** Listing #3. ***
20 REM *** The 'I' command. ***
30 LPRINT "M1000,1000"
40 LPRINT "I0,-1000,-500,500"
50 LPRINT "H"
```

Moves from ① to ② in a pen up condition, then moves from ② to ③ to ④ while drawing lines, then moves to the home position in a pen up condition. (Fig. 27)

Fig. 28

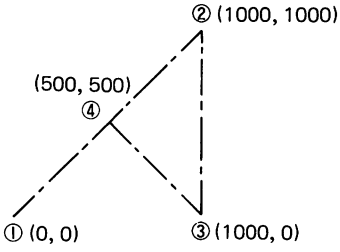
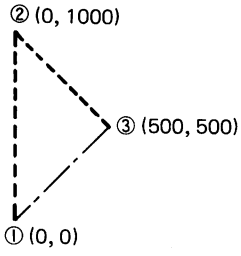


Fig. 29



5. "R" command (RΔx_1, Δy_2)

Performs the same movement as the "I" command in a pen up condition.

```
10 REM *** Listing #5. ***
20 REM *** The 'R' command. ***
30 LPRINT "M1000,1000"
40 LPRINT "RO,-1000,-500,500"
50 LPRINT "H"
```

Moves from ① to ② to ③ to ④ to ① in a pen up condition. (Fig. 28)

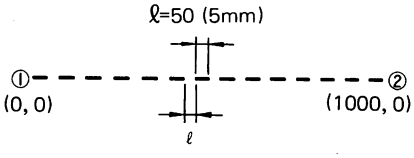
6. "L" command (Lp)

Draws a solid line when p=0 and a dotted line when p=1.

```
10 REM *** Listing #6. ***
20 REM *** The 'L' command. ***
30 LPRINT "L1"
40 LPRINT "D0,1000,500,500"
50 LPRINT "L0"
60 LPRINT "H"
```

In the program, this command may be written either before or after the "B" command (designates the pitch of the dotted line). The initial value is p=0 and makes a solid line. Draws dotted lines in ① to ② to ③ sequence and returns to the home position in a pen up condition. (Fig. 29)
Similar to the "L" command and the "B" command, once designated, the designated condition remains in effect until redesignated, therefore, in the program, the dotted line designation is cancelled on line 40 and the system returns to a solid line drawing condition.

Fig. 30



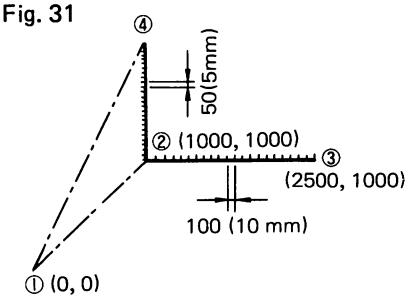
7. "B" command (Bℓ)

Designates the pitch of the dotted lines when drawing dotted lines using the "L" command. "ℓ" is an integer in the range of $0 < \ell \leqq 255$ (25.5mm). The line portions and space portions are equal and the repeat cycle is twice the value of ℓ. The initial value is ℓ = 30 (3mm).

```
10 REM *** Listing #7. ***
20 REM *** The 'B' command. ***
30 LPRINT "B50"
40 LPRINT "L1"
50 LPRINT "D1000,0"
60 LPRINT "L0"
70 LPRINT "B30"
80 LPRINT "H"
```

Draws a dotted line with 5mm pitch from ① to ②, then moves from ② to ① in a pen up condition. (Fig. 30)

Fig. 31



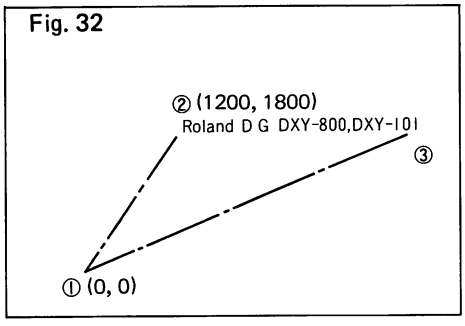
8. "X" command (Xp, q, r)

Draws coordinate axis parallel to the x axis or y axis. p=0 designates the y axis and p=1 designates the x axis. Scale lines are input with spacing designated by "q".
The operation is repeated the number of times designated by "r".

```
10 REM *** Listing #8. ***
20 REM *** The 'X' command. ***
30 LPRINT "M1000,1000"
40 LPRINT "X1,100,15":LPRINT "M1000,1000"
50 LPRINT "X0,50,20"
60 LPRINT "H"
```

Moves from ① to ② in a pen up condition, then draws scale lines 15 times on the x axis with 10mm spacing, the moves from ③ to ② in a pen up condition, then draws scale lines 20 times on the y axis with 5mm spacing, then returns to the home position from ④ in a pen up condition. (Fig. 31)

Fig. 32



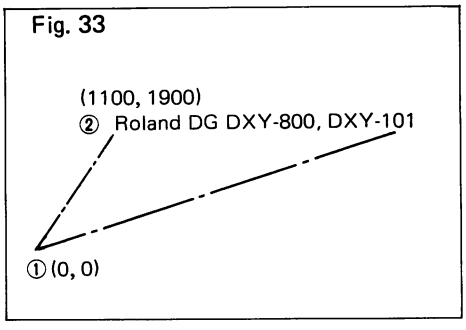
9. "P" command (Pc$_1$ c$_2$ ..... cn)

Prints character designated by "c".

```
10 REM *** Listing #9. ***
20 REM *** The 'P' command. ***
30 LPRINT "M1200,1800"
40 LPRINT "PRoland DG DXY-800, DXY-101"
50 LPRINT "H"
```

Prints "Roland DG DXY-800, DXY-101" from ② to ③ , then returns to the home position. (Fig. 32)
To print characters or character patterns not contained on the keyboard, use "CHR$"

Fig. 33



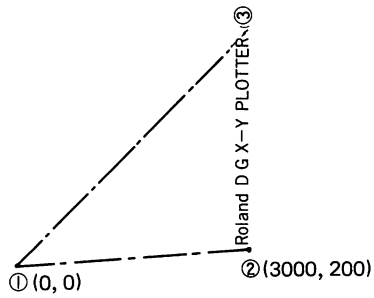
10. "S" command (Sn)

Designates the size of characters and symbols. "n" is in a range of 0 to 15. At n=0, the character size is 0.7 x 0.4mm (0.4 x 0.4mm for symbols). In this case, character spacing is 0.3mm. Character and symbol size and character spacing can be printed up to multiples of (n+1). The initial value is n=3, with character size of 2.8 x 1.6mm, symbol size of 1.6 x 1.6mm, and character spacing of 1.2mm.

```
10 REM *** Listing #10. ***
20 REM *** The 'S' command. ***
30 LPRINT "S9"
40 LPRINT "M1100,1900"
50 LPRINT "PRoland DG DXY-800,DXY-101"
60 LPRINT "S3"
70 LPRINT "H"
```

Draws characters 7 x 4mm in size with 3mm spacing starting from coordinates (1100, 1900). (Fig. 33)

Fig. 34



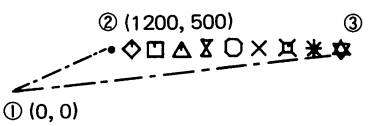
11. "Q" command (Qn)

Designates the rotation angle of the characters. "n" is a value from 0 to 3. "n=0" is 0°, "n=1" is 90°, "n=2" is 180° and "n=3" is 270°. The initial value is "n=0"

```
10 REM *** Listing #11. ***
20 REM *** The 'Q' command. ***
30 LPRINT "S7"
40 LPRINT "Q1"
50 LPRINT "M3000,200"
60 LPRINT "PRoland DG X-Y PLOTTER"
70 LPRINT "S3"
80 LPRINT "Q0"
90 LPRINT "H"
```

Draws characters parallel to the y axis starting from coordinates (3000, 200). Movement between ① and ②, and between ③ and ① is made in a pen up condition. (Fig. 34) The condition designated by the "Q" command remains in effect until redesignation is made. Therefore, line 70 in the program cancels the n=1 designation and the system returns to the initial value. This was also done with the "S" command.

Fig. 35



12. "N" command (Nn)

Draws special characters (marks) centering on the pen position. n is a value from 1 through 10. The respective marks are •,◇,□,△,⧖,○,×,⌑,✳,✡.

```
10 REM *** Listing #12. ***
20 REM *** The 'N' command. ***
30 LPRINT "S14":LPRINT "M1200,500"
40 FOR I=1 TO 10
50 LPRINT "N";I:LPRINT "R100,0"
60 NEXT I
70 LPRINT "S3"
80 LPRINT "H"
```

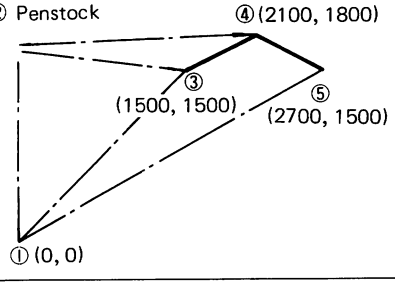
Draws marks in sequence, beginning with n=1 to 10 and starting from coordinates (1200, 500). Movement between ① and ② , and between ③ and ① is made in a pen up condition. (Fig. 35)

13. "ESC" command ((ESC) or CHR$(27) + "n")

Designates mode change. "n" is a value from 0 to 2. n=0 is the PLOT mode, n=1 is the PRINTER mode and n=2 is the SELF-TEST mode.

```
10 REM *** Listing #13. ***
20 REM *** The 'ESC' command. ***
30 REM --- No 1 Printer Mood ---
40 LPRINT CHR$(27);"1"
50 REM --- No 2 Test Mood ---
60 LPRINT CHR$(27);"2"
70 REM --- No 3 Plotter Mood ---
80 LPRINT CHR$(27);"0"
```

Fig. 36



14. "J" command (Jn) (DXY-800 only)

Designates pen exchange for the DXY-800. "n" is a value from 1 to 8 and designates pen numbers 1 to 8, respectively. After pen change, the pen returns to the position prior to the "J" command designation. The initial value is n=1.

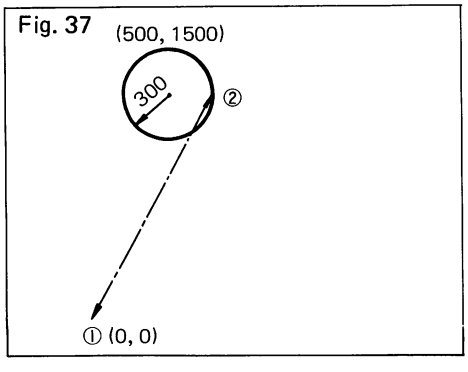
```
10 REM *** Listing #14. ***
20 REM *** The 'J' command. ***
30 LPRINT "M1500,1500"
40 LPRINT "J3"
50 LPRINT "D2100,1800"
60 LPRINT "J6"
70 LPRINT "D2700,1500"
80 LPRINT "H"
```

Initially moves to pen number 1, then returns to the home position, then moves between ① and ③ in a pen up condition, then, in order to change pens, moves to the penstock from position ③, and after changing pens, returns to position ③, then draws a straight line between ③ and ④, then, from position ④, changes pens again, then draws a line between ④ and ⑤, and finally, returns to the home position. (Fig. 36)

Be sure that pens are loaded at penstock number 3 and number 6.

Immediately after turning power on, or after pressing the HOME switch, if a command other than a "J" command is initially input, pen number 1 will be selected.

Fig. 37



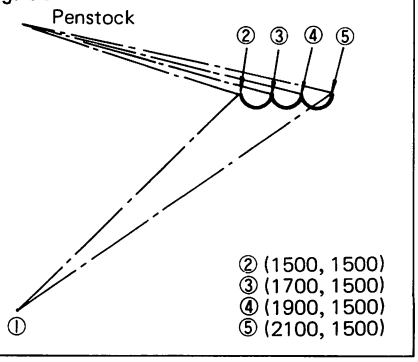
15. "C" command (Cx, y, r, θ_1, θ_2)

Draws circles and arcs. "x" and "y" designate the coordinates of the center of the circle or arc. "r" designates the radius. "θ_1" and "θ_2" designate the initial and final angles and are within a range of 0° to 360°. Drawing is made in the counterclockwise direction.

```
10 REM *** Listing #15. ***
20 REM *** The 'C' command. ***
30 LPRINT "C500,1500,300,0,360"
40 LPRINT "H"
```

Draws a figure 37 with the center at coordinates (500, 1500), a radius of 300 (30mm) and from 0° to 360°, in other words, a circle. (Fig. 37).

Fig. 38



16. "E" command (Er, θ_1, θ_2)

Draws circles and arcs similar to the "G" command, however, the current position of the pen is the starting point for drawing the circle or arc. This command is convenient for continuous drawing of circles or arcs.

```
10 REM *** Listing #16. ***
20 REM *** The 'E' command. ***
30 LPRINT "J3"
40 LPRINT "M1500,1500"
50 FOR I=3 TO 5
60 LPRINT "J";I
70 LPRINT "E200,180,360"
80 NEXT I
90 LPRINT "H"
```

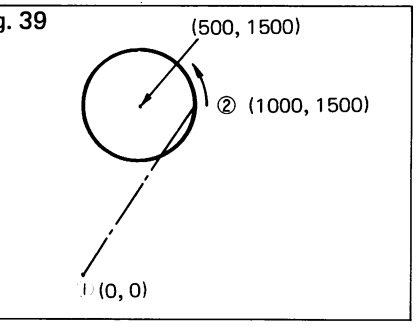
Draws arcs while changing pens. (Fig. 38)
Load pens in penstock number 3 through number 5.

17. "A" command (Ax, y)

Designates the center coordinates for the "G" command and the "K" command. Once designated, it remains in effect until power is turned off or until redesignated.

```
10 REM *** Listing #17. ***
20 REM *** The 'A' command. ***
30 LPRINT "A500,1500"
```

Fig. 39



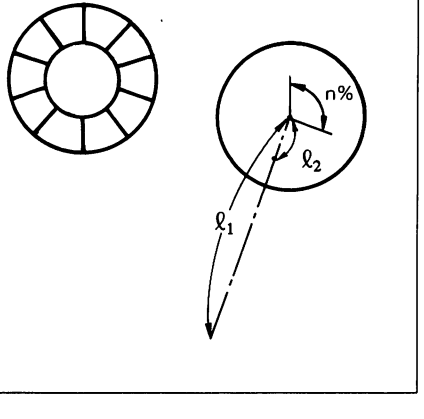
18. "G" command (Gr, θ_1, θ_2)

Draws a circle or arc around the position designated by the "A" command. Designation of the radius and the initial and final angles is performed similar to the "C" command.

```
10 REM *** Listing #17,#18 ***"
20 REM *** The 'A','G' command. ***
30 LPRINT "A500,1500"
40 LPRINT "G500,0,360"
50 LPRINT "H"
```

Draws a circle with the center at coordinates (500, 1500) and a radius of 500 (50mm). (Fig. 39)

Fig. 40



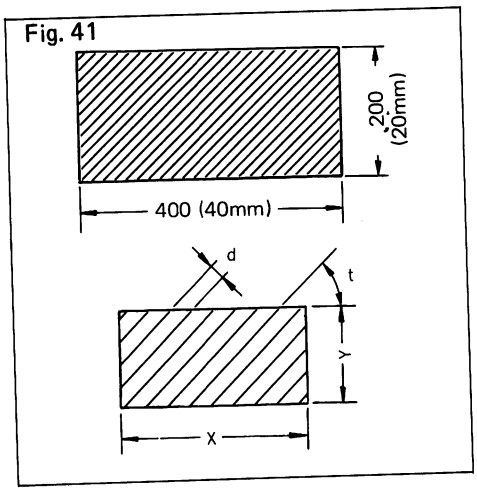
19. "K" command (Kn ℓ_1, ℓ_2)

Draws division lines and extraction lines for the circles drawn using "A" commands and "G" commands. The uppermost part (90°) is 0% and "n" designates the percentage in increments from 1% to 100% in a clockwise direction.

```
10 REM *** Listing #19. ***
20 REM *** The 'K' command. ***
30 FOR I=0 TO 100 STEP 10
40 LPRINT "K";I;",";"500,300"
50 NEXT I
60 LPRINT "H"
```

Draws division lines and extraction lines for the circles drawn in **17** and **18**. (Fig. 40)

Fig. 41



20. "T" command (Tn, x, y, d, t)

Draws hatching or quadrangles. n=1 is for hatching only, n=2 is for boxes only, and n=3 is for drawing both hatching and boxes. "x" and "y" are the respective "x" axis and "y" axis lengths. "d" is the spacing between hatching. "t" designates the hatching angle. t=1 is 0°, t=2 is 45°, t=3 is 90°, and t=4 is 135°.

```
10 REM *** Listing #20. ***
20 REM *** The 'T' command. ***
30 LPRINT "M300,1400"
40 LPRINT "T3,400,200,20,2"
50 LPRINT "H"
```

Draws a 20 x 40mm box with hatching. Furthermore, to draw a box only, as a dummy, designate d=0 and the appropriate value of 1 to 4 for "t". (Fig. 41)

- If the values used in the respective drawing command examples are used just as they are, there will be no need to change the recording paper. (Provided 420mm x 297mm size recording paper is used.)
- If the line numbers are rearranged, programs **1** through **20** can be executed at the same time. (Fig. 42)
- If executed using the following equipment, add the lines as shown to the beginning and end of the sample program.

APPLE II (Apple)

```
10      PR#2            (When interface is plugged into
20      PRINT "....."                the number 2 slot)
 :
1000    PR#0            (Cancels interface card slot designation)
1010    END
```

IBM-PC (IBM)

With an IBM-PC, for drawing hatching and circles, it may take approximately 4 or 5 seconds or more (since a Device Time Out error is generated).

```
10      ON ERROR GOTO  1000
 :
1000    IF ERROR=24 THEN RESUME 0
1010    ON ERROR GOTO 0
```

Fig. 42

Roland D G DXY-800,DXY-101
Roland D G DXY-800,DXY-101
Roland D G X-Y PLOTTER

3. Printer Mode.

The DXY-800 and DXY-101 have a function for printing character codes just as they were input. This function is known as the PRINTER mode. By using this function, data received for making drawings can be checked.

1. Check to see that the power switch is OFF, set the drawing point of origin, load the recording paper, and install a recording pen.
2. Turn the power switch ON while pressing the HOME switch. Or, to get into the PRINTER mode after turning power on, use an "ESC" command.
3. Pen number 1 will be installed in the pen carriage (DXY-800), the system will move to coordinates (200, 2500) and go to an awaiting input condition.
4. To cancel the PRINTER mode, push the home switch and the pen up switch at the same time, or switch to the PLOT mode using an "ESC" command.

- In the PRINTER mode, character strings can be printed with character size of S=3 (2.8 x 1.6mm), 123 characters per line, and 53 lines per page.
- In the PRINTER mode, when 53 lines have been printed, the system returns to the initial page position (200, 2500). Thereafter, if the recording paper is changed and the HOME switch is pressed, the data signal will be read again and printing performed.

4. Error Indication and Recovery.

- **Error indication**

When a condition occurs in which the DXY-800 or DXY-101 cannot operate correctly, the POWER LED blinks to indicate an error has occurred. An error indication is made when any of the following data is input.

1. When an illegal command character is input. (For example "O", "W", etc.)
2. When input is not made in the proper sequence. (For example, when HD200, 500 is input)
3. When a parameter of 5 digits or greater is input. (For example, when M10000 is input)
4. When the pen exceeds the operating range.

- **"M" and "D" commands**

  An error indication is made when a positive value parameter of 4 digits or less is input and a proper command is received and the pen begins to move toward the location of the designated coordinates and begins straight line operation, but a numerical value exceeding x=3500* or y=2600 has been input.

- **"R" and "I" commands**

  When a negative value parameter of 4 digits or less is input and a proper command is received and the pen begins straight line operation using the designated movement value, but the range of absolute coordinates exceeds x=0 to 3500* or y=0 to 2600, the movement in that direction will stop and an error indication will be made.

- **"X" command**

  When a command is received in which the "q" and "r" limit parameters are positive numbers of 4 digits or less, but, due to the drawing start position and the values of "q" and "r", the movement range is exceeded, an error indication will be made.

5. When an illegal parameter is input

- When, for an "M" command, "n" is 0 or greater than 10, or, for a "U" command, when "n" is 0 or greater than 4, an error indication will be made.
- For "B", "S" and "Q" commands, even if an undefined value is input for the "ℓ" or "n" parameter, if that value is a positive number of 4 digits or less, it will be accepted as a correct command and an error indication will not be made. However, in this case, it cannot be guaranteed as to what kind of operation will be performed.

6. For the DXY-101, a "J" command results in an error.

* X = 3500 is valied for DXY-800 and X = 3700 for DXY-101.

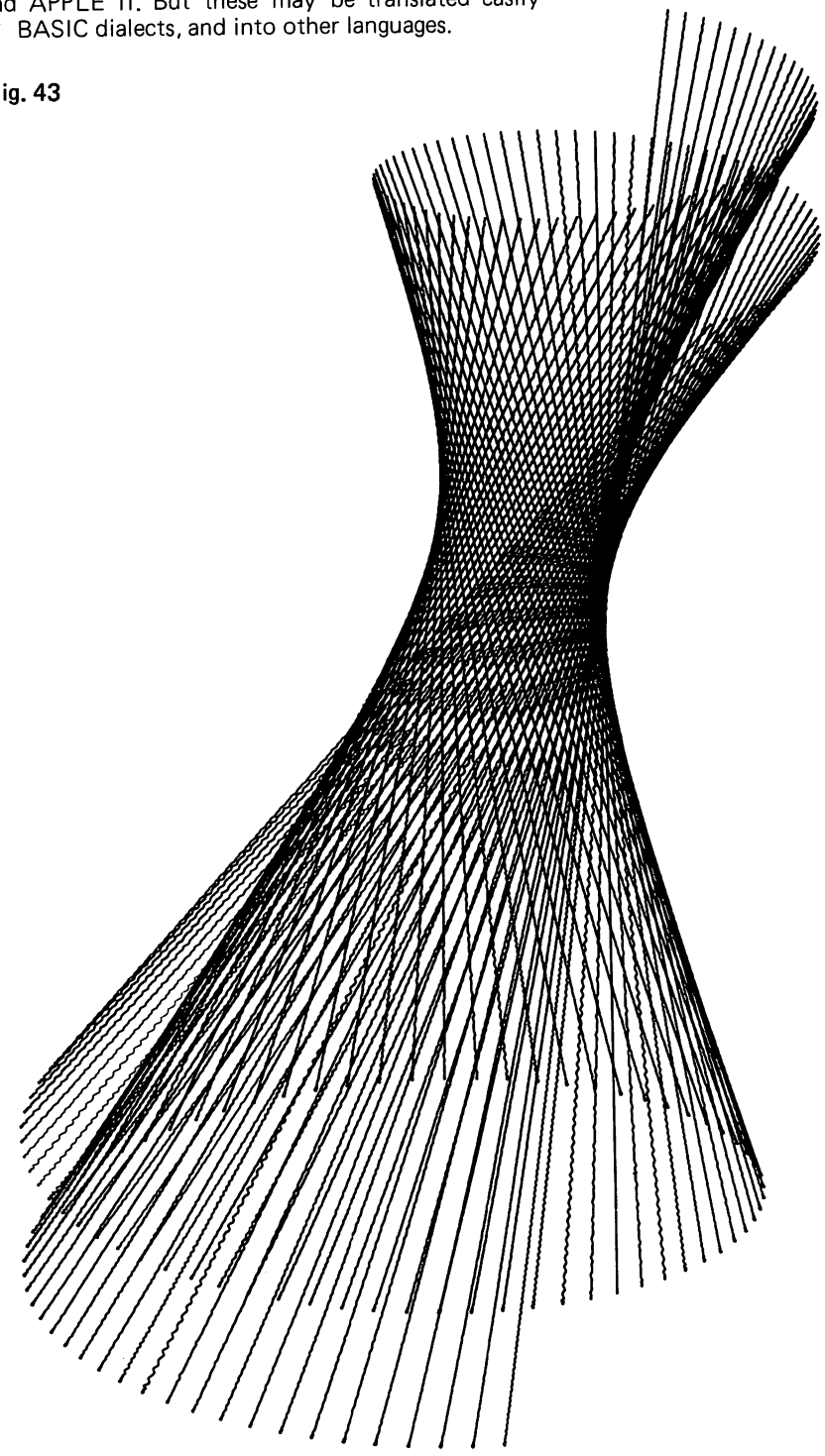
- **Error recovery**

If an error indication is made, further operation cannot be guaranteed. Therefore, the error must be cleared.
Normally, this is done by inputting an "H" command or by pressing the HOME switch.
When an incorrect format has been input and an error indication has been made, thereafter, any input other than "LF" will not be accepted, so input "LF".
The error indication will not be cleared, but all subsequent command inputs will be executed. Also, when an error occurs as a result of exceeding the operating range, even after the error indication is made, drawing operating can be continued, but the accuracy of the pen position cannot be guaranteed.

1. Sample Programs.

The following programs are written in BASIC for IBM-PC, TRS-80 and APPLE II. But these may be translated easily into other BASIC dialects, and into other languages.

Fig. 43



For IBM-PC

```
10 REM ***  SAMPLE PROGRAM  ***
20 REM
30 ON ERROR GOTO 1000
40 REM
50 PI=3.14159
60 FOR A=-60 TO 430 STEP 5
70   X1=2000+INT(300*COS(PI*A/180))
80   Y1=1800+INT(100*SIN(PI*A/180)+A/2)
100  X2=1700+INT(500*COS(PI*A/180-2.5))
110  Y2=600+INT(200*SIN(PI*A/180-2.5)-A/2)
120  LPRINT"M";X1;",";Y1:LPRINT"D";X2;",";Y2
130 NEXT A
140 LPRINT"H"
150 END
1000 IF ERR=24 THEN RESUME 0
1010 ON ERROR GOTO 0
```

For TRS-80

```
100 REM  ***  SAMPLE PROGRAM  ***
110 REM
120 PI=3.14159
130 FOR A=-60 TO 430 STEP 5
140  X1=2000+INT(300*COS(PI*A/180))
150  Y1=1800+INT(100*SIN(PI*A/180)+A/2)
160  X2=1700+INT(500*COS(PI*A/180-2.5))
170  Y2=600+INT(200*SIN(PI*A/180-2.5)-A/2)
180  LPRINT "M";X1;",";Y1:LPRINT "D";X2;",";Y2
190 NEXT A
200 LPRINT "H"
210 END
```

For APPLE II

```
100 REM  ***  SAMPLE PROGRAM  ***
110 REM   N= SLOT NUMBER
120 N=2
130 PR# N
140 PI=3.14159
150 FOR A=-60 TO 430 STEP 5
160  X1=2000+INT(300*COS(PI*A/180))
170  Y1=1800+INT(100*SIN(PI*A/180)+A/2)
180  X2=1700+INT(500*COS(PI*A/180-2.5))
190  Y2=600+INT(200*SIN(PI*A/180-2.5)-A/2)
200  PRINT "M";X1;",";Y1:PRINT "D";X2;",";Y2
210 NEXT A
220 PRINT "H"
230 PR# 0
240 END
```

2. Specifications.

	DXY-800	DXY-101
●Effective Plotting Range	X-axis 350mm, Y-axis 260mm	X-axis 370mm, Y-axis 260mm
●Plotting Speed	180mm/sec (maximum in axial direction)	
●Step Size	0.1mm/step	
●Distance Accuracy	1% or less of traveling distance	
●Repetition Accuracy	0.3mm or less	
●Switches	Power, Pen up/down, Home, Speed Select, Bit Select	
●LED	Power/Error, Pen Up	
●Parallel Interface	Centronics compatible	
Input	$\overline{\text{STROBE}}$ (1 Bit), 7/8 Bit Parallel Data	
Output	BUSY (1 Bit), $\overline{\text{ACK}}$ (1 Bit), ERROR (1 Bit)	
I/O Signal Level	TTL level	
Input Transmission System	Asynchronous	
Input Data	7 bit/8 bit	
●Serial Interface	RS-232C compatible	
Transfer method	Non-synchronous, simplex data transfer	
Transfer speed	300, 600, 1200, 2400, 4800, 9600 baud (Switched using DIP switch)	
Stop bit	Bit 1 or bit 2 (Switched using DIP switch)	
Parity check	Even, odd, none (Switched using DIP switch)	
Data bit	Bit 7 or bit 8 (Switched using DIP switch)	
●Recording Pen	8 (Black, red, brown, blue, green, purple, orange, pink)	1 (Black)
●Power Supply	AC adaptor (DC +9V, +28V)	
●Power Consumption	20W	
●Dimensions (W x D x H)	19-1/2" (W) x 17-1/8" (D) x 3" (H) in (496 x 435 x 77 mm)	
●Weight	4.1kg (9 lb)	4.0 kg (8 lb 13 oz)

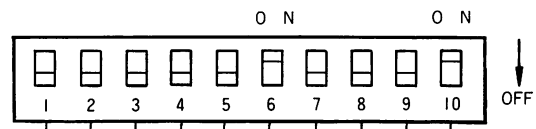
* Specifications are subject to change without notice.

3. DIP Switch Settings. (For RS-232C Interface)

Factory settings

- Parity check . . . . . Even
- Parity check . . . . . Yes
- Baud rate 9600
- Stop bit . . . . . Bit 2
- Data bit . . . . . Bit 8

Fig. 44



Switch Number	Function		
1	Baud rate	300 baud	
2	"	600 baud	
3	"	1200 baud	
4	"	2400 baud	
5	"	4800 baud	
6	"	9600 baud	
7	Parity check	ON: ODD	OFF: EVEN
8	Data bit	ON: 7 bit	OFF: 8 bit
9	Stop bit	ON: 1 bit	OFF: 2 bit
10	Parity check	ON: YES	OFF: NO

(Notes)

- Switch the DIP switch to match the specifications of the computer side. (Parity check, stop bit and baud rate)
- For baud rate switch switching, be sure only one is on. Also, when switching, first turn all switches OFF then turn the switch for the desired baud rate ON.

4. Options.

The following separately sold options are available for the DXY-800 and DXY-101.
Please consult a Roland D G office or your dealer for details.

Pen holder set	XY-4PH	4/set
Exclusive pen set	XY-4SPA	(Black) 4/set
	XY-4SPB	(Black, blue, red, green - 1 each) 4/set
	XY-4SPC	(Orange, purple, brown, pink-1 each) 4/set
Connection cable (Parallel)	XY-PC6	For NEC PC8801
Parallel interface card	Parallel Card	For APPLE II

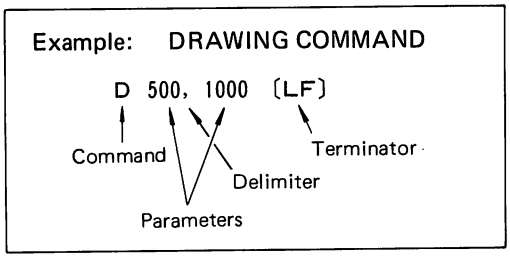
5. When Using Machine Language with the DXY-800 or DXY-101

1. Control method

DXY-800 and DXY-101 control format is as follows.
COMMAND, PARAMETER, PARAMETER · · ; PARAMETER, TERMINATOR.

Commands are single English capital letters listed in the "COMMAND" section of the Drawing Command Table.
twenty commands are available such as "D", "M", "I", etc. Parameters provide information for the above commands and are normally input using numbers, however, in some cases, such as for the "P" command, letter codes may be used, and the "H" command has no parameters. A command is used to separate the parameters and is known as a "delimiter" and by using this for the "D" command or "I" command, consecutive parameters can be input. The terminator indicates the end of the drawing command and is input as "LF(0A)", "CR(0D)" or "CRLF (0D0A)".

Fig. 45



2. Drawing command classifications and abbreviations
   1) "L", "B", "S", "Q" AND "U" commands, once input, remain in effect until changed.
   2) "X", "H", "N" and "Z" commands take effect after a terminator is received.
   3) The "P" command does not require a delimiter between parameters, but prints each character as it is received.
   4) The "C" and "E" commands draw circles and arcs individually.
   5) The "A", "G" and "K" commands are used in combination to draw division lines and extraction lines for circles, arcs and circular graphs pie charts.
   6) The "T" command is used to draw hatching and quadrangles.
   7) "M", "D", "R" and "I" commands perform vector movements.

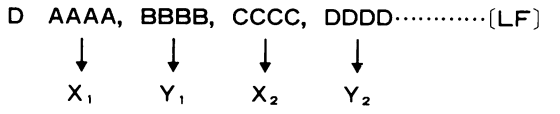
Drawing commands in 1) through 6) above have no abbreviations. They begin with a command and end with a terminator.
For the four commands in 7) above, the following abbreviation methods are available.

Fig. 46

```
D AAAA, BBBB 〔LF〕
D CCCC, DDDD 〔LF〕
      ⋮
D ·····, ····· 〔LF〕
```

The initiation using a command and termination using a terminator as shown above may be abbreviated as shown below.

Fig. 47



In other words, if input as shown above, if a comma follows Y_1, the plotter starts to draw a straight line from the current position in the direction of X_1, Y_1 and upon reaching X_1, Y_1 goes to a condition in which it is able to receive X_2, Y_2. If a delimiter follows Y_2, it moves in the same manner, executing the "D" command until receiving a terminator.

ROLAND CORP US

7200 DOMINION CIRCLE

Los Angeles, CA 90040

213-722-6933

Roland DG

ROLAND DG CORPORATION